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The Institute of British Foundrymen

The Institute of Vitreous Enamellers

The Welsh Engineers' and Founders' Association

The Foundry Trades' Equipment and Supplies Association

Institute of British Foundrymen

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Patent Law Amendments

The legislature has recently amended the laws governing the life of Patents with the object of mitigating hardships caused to inventors through wartime conditions preventing normal exploitation. We believe this to be essential if the skeleton upon which the Patent situation is based is adherence to the principles of the International Convention. It should be remembered, however, that all countries are not members of the Convention and this fact should be borne in mind in the creation of new and the amending of old Patent laws. The whole system of the granting of Patents and their subsequent protection has been built up patiently over the last two hundred years and gave general satisfaction until comparatively recent years. Nowadays in certain fields, which are apparently the preserves of manufacturing trusts, the inventor virtually has to rely on the generosity of the trust for his reward. The system employed is to acquire what are deemed to be basic Patents and constantly reinforce them by Patents of additions resulting from the experience gained in manufacturing, together with the work turned out by research departments. Thus Patents can be used to extend the monopoly inherently implied in holding of a Patent to the much wider industrial monopoly, which obviously was never intended. So clever have the lawyers been, that the Patent position is now effectually used to stop price-cutting by shopkeepers! This is one of its better aspects.

One of the features of the Patent law is the too scrupulous regard in wartime for enemy vested interests, because it is supposed to be reciprocal. Only recently we heard of a threat to withdraw a licence for the manufacture of essential war material, because there was some question of a contribution to the technical literature of the subject by the staff of the manufacturing firm. This is obviously not the use to which Patents should be put, and it is a policy to be highly deprecated, especially as the inhibition is imposed to protect enemy interests. It is difficult to imagine that the enemy adheres to the niceties and decencies in protecting the Patent rights of Allied inventors in their own countries. An abuse of this nature obviously calls for drastic action.

There are always three angles to any piece of Patent litigation—the two parties to the case and the general public. The complete nullifying of a Patent by the court may throw what was thought to be covered by it into the *domain publique* and thereby give anybody the right to exploit the process or machine in question. The lawyers generally contrive to avoid this, if at all possible.

From what we have said above, coupled with a cost of £1,000, to get protection in all countries under the Convention, it will be clear that the taking out of Patents is not lightly to be undertaken by the individual, especially in certain fields. It should be remembered that the mere granting of Patent rights gives no Government guarantee of validity—only a High Court action can confer this distinction. It is on these grounds—for we believe inventive genius should be rewarded—that we suggest that there is need for post-war legislation which will assume that all potential patentees are not millionaires. An essential feature to our mind should be a sort of "prenatal clinic" whereat the inventor could receive unbiased advice as to novelty and value. At the moment this is done by Patent agents, some of whom are really expert in some fields, but few in all. Cognisance should be taken of the case of the research associations and their staffs, for here the position is far from satisfactory, as money is provided for research and there is none available for legislation. Finally, thought should be given to an invention starting its life as a contribution to a suggestion box, which ultimately turns out to be a substantial money-making invention of a patentable character.

Contents

	PAGE
Patent Law Amendment	161
American Copper Situation	162
Notes from the Branches	162
A.F.A. Code for Protection of Foundries	162
Book Review	162
Random Shots	162
The Running and Risering of Iron Castings	163
Strainer Cores	166
Swedish Iron and Steel Notes	166
The Manufacture of Malleable Castings by the Whiteheart Process	167
High Purity Zinc, and Zinc Alloys for Die Casting	169
Damage Proneness of Factory Plant	170
Catalogues Received	170
Canadian Non-Ferrous Metals	170
The Week's News in Brief	172
Raw Material Markets	174

American Copper Situation

BY "ONLOOKER"

In this country we have never been very much given to the cult of statistical information, and now in wartime there is not unnaturally a definite taboo on the publication of figures which might give any help to the enemy. Knowledgeable people might well—and probably do—by deduction arrive at conclusions on the subject of consumption in these days of tremendous industrial activity, but they keep their estimates to themselves, and these are certainly not seen in print. Across the Atlantic less reticence has been displayed up to now, possibly because America has always provided figures of a fairly full and informative scope, the Year Book of the American Bureau of Metal Statistics being a most useful guide to those who wish to study the trend of events on the statistical side of the non-ferrous metals world situation. Since the outbreak of war some gaps have appeared in tabulated lists, and these will now increase, for no further non-ferrous figures for America are to be made available in foreign countries in future. All that can be said at this juncture is that when at some future time statistical data covering the full war effort is given to the world the story told will be one of very great interest to the metal community, who, in common with the public generally, have not been placed in a position to realise all the difficulties.

It seems likely that throughout the whole of last year deliveries of copper to consumers in the United States were assisted through the inclusion of Chilean brands released by the Metals Reserve Company from their holding built up out of purchases of Latin American copper. Actually deliveries had begun to show a rising tendency towards the end of 1940, and were exceeding the total output of refined, October for example showing production at 83,000 short tons, with deliveries to domestic consumers at about 103,000 tons, but stocks fell by a corresponding amount to 164,000 tons. This downward trend in reserves of refined copper continued into the New Year, the figures for February, for example, showing that while the production total was 93,654, deliveries amounted to 112,808, stocks coming down from 116,341 tons at January 31 to 97,689 at the end of February. A further fall in stocks to 89,873 tons was seen at the end of March, but the Copper Institute's figures for that month included a total of 31,201 tons of imported copper, and thereafter an inclusion under this heading has been shown. For the ten months from March to December some 380,000 short tons of Latin American copper were delivered to domestic consumers in the U.S.A., but in spite of this the second half of the year saw a sharp decline in reserves of refined copper, for the munitions drive was being intensified, and it is also not unlikely that copper was despatched to Britain and to Russia. The low level of refined stocks was seen at the end of September when 63,370 short tons was recorded, but thereafter there was a larger contribution of imported copper (over 50,000 tons in December), and at the end of 1941 stocks of refined copper in the U.S.A. stood at 75,564 short tons.

The January details came out as usual, and incidentally showed a rise of about 6,000 tons in stocks. So far as production is concerned the year started well, 90,000 tons being the figure mentioned for January, and it may well be in view of the 5-cent bonus granted in respect of tonnage turned out this year in excess of the 1941 total that this will be improved upon. Apart from this a price above the 12-cent maximum is being paid by special arrangement in certain high cost areas so that every effort is being made to raise domestic output as much as possible in order to meet a new record consumption level.

Book Review

Practical Handbook on Oxy-Acetylene Welding. Published by Suffolk Iron Foundry (1920), Stowmarket. Price 5s.

This little book has been compiled from articles which have appeared in the house organ of the publishers, and in this new form will no doubt be acceptable to the practical operator. There are more than 170 well-illustrated pages and no less than 49 chapters. Moderation in the use of the trade name "Sifbrone" is recommended for future editions, for which there is every prospect of being a demand, as the book has many good qualities.

Notes from the Branches

Wales, Monmouth and West of England Branch.—The annual meeting of the above Branch for the election of officers and any other business of interest to the Branch will be held at the South Wales Institute of Engineers, Park Place, Cardiff, on March 14, at 3.30 p.m. At the conclusion of the election of officers, it is hoped to continue the discussion on "Making Castings in Steel," introduced by R. J. Richardson at the last meeting. A meeting of the Branch Council will be held prior to the B.G.M. at 3 p.m.

West Riding of Yorkshire Branch.—The next meeting of the Branch will be held at the Technical College, Bradford, on Saturday, March 14, at 6.30 p.m., when the fourth discussion of the "Specimen Casting" will be opened by Mr. Harold Balme, who will deal with the "Potential Defects in the Specimen Casting."

EDITORIAL INDEX TO VOL. 65

The Editorial Index to Volume 65 of the Journal, July to December, 1941, is now available. Readers who wish to receive a copy should make application to:—
3, Amersham Road,
High Wycombe, Bucks.

A.F.A. Code for Protection of Foundries

Recently the American Government requested the foundry industry to draft a set of rules to be used as a guide in providing safeguards for foundries during wartime so that maximum operating capacity will not be endangered. The American Foundrymen's Association consequently has formed a committee to draft such a code, under the chairmanship of James R. Allan, International Harvester Company, Chicago, chairman of the A.F.A. Industrial Hygiene Codes Committee, which has already produced five codes of recommended good practice. Until the code is available, Mr. Allan suggests that each foundryman study his individual problems in order to guard against sabotage and fifth-column activities, to ensure an effective black-out, and to protect essential facilities in the event of aerial bombings.

Swedish Ore Company

Luossavaara-Kirunavaara A/B., the Lapland iron ore company of which the shares are held by the Swedish Government and by the Trafik-A.B. Grängesberg-Oxelösund, made a gross profit of 57.5 million kr. for the year ended September 30 last, which is 18 million kr. less than in the previous 12 months. As a result of a reduction in taxation payments, the net profit declined from 38.1 to 34.1 million kr.; 15 million kr. is being paid to the Government and a similar sum to the Grängesberg company. The reduction in gross profit is attributed to the decline in ore sales caused by the temporary suspension of shipments *via* Narvik.

Random Shots

The opinion has been expressed more than once in foundry circles that the R.A.F. should "have a pop" at the Renault works in Paris. Those foundrymen who visited the Billancourt works during one of the International Conferences in that city have long realised the vastness of the premises and its potentialities as a munition factory. It is a relief to feel that many shops are put out of commission for some considerable period, and it is hoped that the R.A.F. will visit it again every time it becomes ready to work at full speed. No doubt a strong feeling of reluctance to cause death and injury amongst innocent French people, working for the Nazis against their will, has deterred operations until now, but those who knew the Renault factory well in pre-war days will remember that of all factories in France, that was the one which employed the highest, and indeed almost unprecedented, percentage of foreigners. Not that that lightens the responsibility of causing death amongst helpless civilians, because those foreigners were not German so much as men drawn mostly from countries now oppressed, who would equally well hate working for the Nazi war machine.

* * *

How often one hears the rejoinder, when a bit of neat handywork is being admired: "Oh, I did it mostly whilst I was fire-watching." Here is an idea for anyone of an inventive turn of mind to develop on just such an occasion. A youngster, who had been obliged to spend many weary days in bed, had the bright notion of rigging up a dartboard in his bedroom. The wall opposite the head of the bed was duly cleared of pictures, and the board put up in a direct line with the bed. The convalescent could then practise scoring a bull's-eye with great vigour, but there was, of course, one great snag. The darts wouldn't return of their own account to the bed! So that the game did not enjoy a very long popularity. The invention, therefore, would be in the nature of a mechanical dart returner. One suggestion already thrown out is that a magnet should be attached to one of those expanding trellis arrangements which the lier-in-bed (be he invalid or merely lazy) could manipulate himself; though, what with invisible rays and the development of radio location, many newer ideas would doubtless spring to the mind of a born inventor.

* * *

It is not given to all, however, to invent things, and there are many other ways of filling in the wearisome hours of the night watch. "Marksman" recently saw an exceptionally fine stock book for stamp duplicates made by a fire watcher who prides himself on being a "bit of a handyman." Any philatelist who has examined his duplicate book will appreciate its intricate construction and probably feel that he ought to take a course of book-binding lessons before starting on such a task.

* * *

Any Brass Mines, To-day?

The Bureau of Mines recently received a phone call from an official of the Office of Production Management, metals and minerals division, asking about "brass mines."

"What are you trying to do, kid us?" said a B.M. expert. "What do you mean, kid you?" protested the O.P.M.-er. "I'm serious. We want to find out all we can about brass mines—how many there are in the country, where located and the total annual production of brass ore."

"Mister, we'd like awfully well to accommodate you," was the flabbergasted reply. "But any schoolboy can tell you that there just is no such animal as a brass mine. Brass is an alloy made chiefly of copper and zinc."

"MARKSMAN."

The Running and Risering of Iron Castings

INFORMAL TALK ON GATING PROBLEMS ILLUSTRATED BY CINE FILMS

A meeting of the London Branch was held at the National Liberal Club, London, on January 31, 1942, Mr. R. B. Templeton (Branch-President) in the chair. At the opening of the meeting the Branch-President presented the Diploma of the Institute to Mr. McRae Smith for the great contribution he had made to the metallurgy of cast iron. In doing so, the Branch-President said that those who heard Mr. McRae Smith's Paper would remember that he was rather pressed for time, as the general meeting of the Branch had been held previously. It was a Paper to which more time should have been devoted and at some later date it was hoped to be able to ask Mr. McRae Smith to speak again on the subject.

MR. MCRAE SMITH expressed his sincere thanks to the Institute for the Diploma and said that if he could do anything in the future to assist the foundry industry generally he would be only too pleased to do so. The greatest reward to readers of Papers was the great interest taken in them and in that respect he had felt amply repaid.

The CHAIRMAN, before calling upon Mr. E. M. Currie to give a Paper on the subject of running and risering of castings, said he was very pleased to see such a large attendance, as it was extraordinarily difficult to get people to attend Saturday afternoon meetings, and it was a compliment to Mr. Currie that so many had turned up. There was no need to introduce Mr. Currie in a formal manner, but he would like to say that he had been associated with him for the past 8 years and he must frankly say it had been a great help to have Mr. Currie with him, as he was a man who knew the very heart and core of the casting industry.

THE RUNNING AND RISERING OF IRON CASTINGS

MR. CURRIE said he did not propose to give a Paper on this subject but to start an informal talk on a matter which was often too easily briefly dismissed as gating the mould. It might be claimed that there were problems to be considered, such as labour, management, costing, or metallurgical, which might be considered more important than how the metal got into the mould. However, in his view there was not one single operation in the foundry industry which was more important than any other and to start right was to finish right; the job of the foundry was to produce a perfect casting.

A general study of the foundry industry showed that there was, on the average, some 5 to 6 per cent. of all castings made which were defective and, taking the industry as a whole, this meant there was nearly a quarter of a million tons of castings which had to be made again every year. The metal, of course, was not lost but time was irretrievably lost, as were all the materials, other than the metal, which made up castings. There was no need to stress the importance of that at the present time.

He had had the opportunity during the past 10 years to study the "defective" records of some 40 foundries in this country and on the Continent. This showed that some 40 per cent. of the total number of defectives was due to sand, slag and scum in the casting. The main point was that proper gating would definitely prevent slag getting into the mould and the sand or scum getting into the casting. That might seem a rather bold statement but the point had been so well established in the case of the foundries he had mentioned that it could be well applied to the whole industry. The scope of this subject was vast and well worthy of further practical research. He had intended in this talk to try and deal with both gating and risering, but in the time available, in order to do at least bare justice to one of these subjects, he must concentrate on gating, and deal with the basic principles in a manner which he hoped would stimulate interest.

Reducing Defective Castings

There was no magic formula for getting rid of troubles in the foundry from the causes he was going to mention, but some slight degree of imagination and commonsense applied to most jobs would easily halve the number of defective castings. Of course, in the case of the supervisory staff, their difficulty was in making sure that their instructions to the men were effective and lasting. Therefore, some method of stirring the imagination of the men and effecting a lasting memory was absolutely necessary. He had found that picturisation was ten times more effective than any number of talks, but it must be fairly novel to be remembered. Owing to conditions in the foundry there were obvious limitations in what could be done in this way in the present state of the art of photography. A method he had found effective was to make a series of instructional slides dealing with gating from the very start and carry on to the finish where the metal enters the mould, and to show afterwards one or two examples of actual pouring practice, using simple castings, which drove home the points which were being made.

Mr. Currie then showed a series of slides of the nature he had indicated, with which he took his audience from the ladle to the mould, and demonstrated the principles he had outlined in his opening remarks. Speaking of the many attempts that had been made to improve the ladle form, he said the ideal, if it could be attained, and made controllable, would be the bottom pouring ladle, but the stage of its real effective use had not yet been reached in the grey iron foundry. The next best thing was the tea-pot spout, which should extend right from the bottom of the ladle. The whole idea, of course, was to start with really clean metal. The practical man did not need telling what happened if this was not the case, but it was a point that had continuously to be emphasised.

Pouring and Basin Shape

Passing to the question of pouring, he remarked that it might be said his illustrations were obvious, but he stressed the fact that the slides were being used to stimulate imagination on the part of the moulder, who probably knew most of these things but was very apt to forget. In the same way, discussing basin shape, he admitted the points brought out by the slides were more or less obvious, but, he asked, how often were the errors shown on the slides far too often seen in the foundry. It was no use saying that the obvious improvements could not be done or that there was not time to do them. They could be done quite easily—often in shorter time than to do the job incorrectly. The majority of foundries, who took a pride in their work, would go to the extent of using runner bush machines, plate patterns, and making the runner bushes in oil sand or anything they needed in order to make the perfect casting. This made it easier for the moulder to keep his basin full, which ensured clean iron going down to the mould.

Showing slides to illustrate a few of the faults that could occur, Mr. Currie laid great stress on the necessity for having a clean basin, for a clean basin meant that half the work of getting a clean casting had already been done. There were far too many instances in which the runner basin was left in an untidy state which could be avoided with such little more trouble to make a smooth basin. It was quite a simple matter to cure that trouble, and some slides were shown to illustrate that point.

On the question of down-gates, slides were shown of the faults which Mr. Currie said he had seen hundreds of times within the past 10 years, and he followed up with slides showing how these faults can be remedied in a simple manner. He suggested it would pay the members of supervisory staffs to produce a little booklet setting out the methods which would suit their own particular foundries, giving the types of runner and the sizes of runner most suitable, and also methods of trapping the dirt. This would be a permanent reminder to the men of the methods which had been proved to be very effective. In one example, if the runner bar was larger than the down-gate, the runner bar would never be kept full of metal and dirt could easily reach the in-gate, and it was pointed out that in order to apply the fundamental principles of gating, it was necessary to consider very many points of detail of this nature exhaustively and fully. Special attention was paid to the question of dirt traps, and it was pointed out that although this could be gone into in great detail in each foundry, care had to be exercised in what was taught in that respect. For instance, Mr. Currie said he had taught a certain foundry at least 10 different ways of trapping dirt, and about a month later he found that one moulder had incorporated several of these different methods in the one single runner system. As to how the metal ever reached the mould from the basin he had never ceased to marvel at!

Slag Formation

Methods were illustrated of how the moulder could be instructed to prevent slag formation, and it was emphasised that it would pay to take three or four average examples of castings made in a particular foundry and study them closely and determine how the gating could be carried out. There would be one best method, although there might be half a dozen just as good. The moulder should be taught exactly how the metal entered the mould, and why metal did not cool down uniformly. In this connection crayon drawings in colours showing the operations and temperature differentials were of great use, and Mr. Currie again showed slides illustrating what he meant. Instruction of this sort in connection with sizes of runner bars, gates and basins might seem to be somewhat troublesome, but it had been proved well worth while no matter what the type of foundry. Proper methods could be instilled into the moulders without any real trouble at all when the men had had explained to them what was being done and what was the ultimate aim. The men should be shown the full results of following these best methods. The ciné film was extremely useful in this connection as compared with the still slide, for it was then possible to demonstrate the exact process from start to finish in motion. The possibility of instructing the moulders in the production of the perfect casting in this way was strongly emphasised, and in order to drive home these points Mr. Currie then showed some colour films of the running of castings and the flow of metal, which he claimed were unique.

The first film, he said, was produced by the Greenlee Foundry Company, a Meehanite licensee in the United States, as the result of their experiencing a considerable amount of trouble from defective castings, and Mr. Currie said he had been assured that the interest taken by the moulders in this particular film had been

Gating Problems

remarkably effective in reducing the number of defectives produced.

Parts of the films were run through at slow speed to enable the action more clearly to be seen, and the second film showed further pouring and casting of several different moulds and gating systems.

In conclusion, Mr. Currie expressed his thanks to the Meehanite Research Institute for allowing him to show exclusively to the London Branch of the Institute of British Foundrymen these films and slides.

DISCUSSION

The BRANCH-PRESIDENT said Mr. Currie had given a most instructive and interesting talk on a subject which was the very core and centre of the industry, *viz.*, the foundry floor. Most Papers before the Branch were of a rather scientific nature, but the talk given by Mr. Currie would appeal to the practical men, and it was those whom he would like to hear in the discussion deal with the problems they had. At the same time, he expressed the hope that foundry managers would take part in the discussion.

MR. J. F. KAYSER, Assoc. Met., said that he had been a member of the Institute for 20 years, and this was one of the most remarkable Papers he had ever heard presented to it. Although the audience at this meeting was large for a local Branch, it was, for the Institute as a whole, disgracefully small. It was the sort of Paper which it would be well worth while bringing to the notice of every foundry in the country, for he was certain it would do a very great deal to relieve the pressure on foundries at the present time. He had been rather surprised to hear the author indicate that some people did not appreciate the importance of running and risering. There might be problems which were equally pressing, but the author would agree that there was nothing in the industry which was more important. It might be true that, as far as the general foundryman was concerned, there was 5 to 6 per cent. of defective castings, but, as far as the general user was concerned, the castings delivered were usually so bad that certainly over 20 per cent. of them ought never to have been sent out!

Runner Basins

Commenting on runner basins, he pointed out that the slides showed them to be quite full of metal. Personally, he had never handled cast iron at all, but had dealt mostly with high-duty alloys varying in weight from a few lbs. up to half a ton, and he did not always find it was the best practice to have the basin full, because the runner basin was used in many cases to get the metal into the mould, and it was also used to some extent as a vent to allow the escape of, he would not say gas from the mould, but the air. It seemed to him to be rather a question of size. In the case of very small castings, it seemed to him it would be rather difficult always to keep the runner basin full, as it was necessary to stop, and, when dealing with the more expensive metals, how did one know when to stop, because, with small castings, it was better not to have a riser, but just a runner?

At the present moment he was not engaged in making castings, but in using them, and had, fortunately, got into touch with a number of sources of supply of Meehanite castings. It was only recently he had seen a foundry where these castings were produced, and the thing which appealed to him was the neatness of the mould. There was no loose sand in evidence. The moulds looked real masterpieces, which was what they always should be. It had been said that horn gates were not so popular. Was that anything to do with the fact that it was almost impossible to get a horn gate that was really clean? In general, it had to be pulled out of the sand and, personally, he could never see how they could be obtained clean.

Finally, he asked whether the British Cast Iron Research Association could carry out a complete research on the lines indicated by Mr. Currie's films. The expense would not be colossal, and the use of colour actually facilitated matters. In another branch of industry he had used motion pictures quite extensively, and much better results were obtained with coloured films than with black and white.

A Film and Slide Library

MR. E. H. BROWN, speaking on the question of wasters, said his experience was that some 60 or 70 per cent. of wasters were due to gating troubles. It was quite true, as Mr. Currie had said, that there was no magic formula in the foundry, but everybody wished sincerely there was, so that everything could be laid down on hard-and-fast lines. Mr. Currie had shown something which he himself had never seen before. These instructional slides were of the greatest possible interest, and, in view of what Mr. Currie had shown, he again stressed a point he had mentioned on other occasions. Mr. Faulkner and the late Mr. Oliver Stubbs were very much interested in it, which was the establishment of some film and slide library through the organisation of the Institute, which would be available to any of the members for instructional work. He raised this question again because he believed that all those present appreciated how much benefit they could obtain from a series of films such as they had just seen. He had put into one of the foundry technical courses some 200 slides which he had at the time, and he believed they were still available throughout the country somewhere and could be organised. He was quite willing now to provide some 50 or 60 slides which he had, but he did not know what other people would be willing to do. Personally, he felt the time was ripe—and this meeting emphasised the point—for some form of organised instructional work along the lines he had indicated which would not incur any great expense compared with the results to be obtained.

MR. L. E. SLATER said he noticed in the illustrations there was no stopper in any of the basins. With regard to slag or scum, might not this be due more to turbulent flow in the mould? That, of course, was due to incorrect design of the in-gate, and he was pleased to see one illustration in which the entry end of the in-gate was larger than the one that joined under the channel. That was a point to be stressed. Could Mr. Currie give any information as to preventing turbulent flow, because more often than not, to check the metal it was necessary to have the entry into the riser larger than the entry into the mould, because the spinner gate or riser was often used as a feeder as well. Referring to the whirl gate, he asked whether Mr. Currie could give any information as to whether the metal should go clockwise or anti-clockwise.

MR. C. H. KAIN remarked that, having regard to what had been said for many years about the difficulties of founding, and of founding being an art and not a science, and the like, he felt it was a very bold and constructive step on the part of Mr. Currie's organisation to isolate one factor in the production of castings and to study it just as the more highly technical metallurgical aspects were normally studied. At the present time he was very interested in two aspects of the Paper. One was the diagnosis of wasters and the other was education. Could Mr. Currie give further details of the analysis of wasters which led him to the statement that 40 per cent. of wasters were due to gating troubles? Also, he was very much involved in various educational schemes both for foundry apprentices and, in some cases, for foundry managements, and he wished to ask if Mr. Currie could give some idea as to how the information he had given during his talk was put across in the foundry; how did he tackle the broadcasting of this information in the 40 foundries to which he had referred?

Author's Interim Reply

MR. CURRIE, replying to the discussion as far as it had gone, said it had been his experience that it was not so much a question of getting this information over to the men as to the foremen and the supervisory staff first and foremost, because, to a certain extent, unless the foreman himself really understood and laid out his programme to fit his own particular types of casting, it was useless for anyone to go to any particular foundry and deal with such a big subject in a very broad manner. Such a method did not achieve results. It was necessary to take a particular foundry and its particular castings in detail, and the best way of doing that was to convince the supervisory staff first of all.

Replying to Mr. Kayser on the question of keeping runner basins full, he agreed that a great deal depended on the type of metal being dealt with. He had realised that from the start and had confined himself to the gating of grey cast iron and high duty irons. Obviously, as he had shown in his early slides, a good casting depended on making sure of getting good clean metal, by thorough skimming or by means of teapot spout ladles. He agreed with what Mr. Kayser had said with regard to the horn gate. In these days there was not time available to make a horn gate properly. It took a good deal of fixing, and to be used properly it must be fitted and packed properly with sand and withdrawn cleanly, and even after all that it was difficult to be sure it was absolutely clean. Furthermore, where there was an ordinary runner bar at the joint of the mould, it was always possible to see whether the mould was clean, but that was certainly not the case with horn gates.

As regards what Mr. Brown had said concerning his statement of the percentage of wasters due to the gating problems, Mr. Currie said he had obviously had to take a relatively broad view in arriving at such a definite figure as he had given previously. It could be said, as the result of the analysis of the 40 foundries already mentioned, that between 60 and 65 per cent. of all wasters was due to what might be classed broadly as moulding problems, and when these moulding faults were split up it was surprising how much could be put down to bad gate or bad basin practice. That, of course, might be further detailed to such things as making the runner bar or in-gates in black sand instead of facing sand or some similar fault, but that was merely one of the points which linked it to the gating system classification. He certainly agreed with Mr. Brown that it would be an excellent idea to have a library of instructional slides, and he believed he was correct in saying that the Institute, as a whole, was already doing that. At the same time there was no reason why the London Branch should not carry out the same idea as well. Everybody had the good of the industry at heart, and would be willing to help in that direction. The Meehanite organisation would, he was sure, be willing to co-operate.

Stoppers and Whirl Gate

It had been mentioned by Mr. Slater that the illustrations did not show the use of stoppers. That was true, and the reason was that the majority of to-day's illustrations dealt with small castings. Where it was a case of a casting weighing a ton or more it probably paid to put a stopper over the down-gate, but frankly he did not like an iron stopper for the down-gate for several reasons. Too often did the moulder continue to use it when the bottom was burned away, and the first iron flowing into the basin

Gating Problems

was certain to wash dirt straight down the down-gate. Therefore, wherever possible everything should be done to make things foolproof. He did not agree with Mr. Slater that scum was caused by turbulent flow if the runner system was made clean. Wherever possible patterns should be used. If necessary, use facing sand around these patterns and get a good clean finish.

With regard to the whirl gate, it did not matter whether the metal went clockwise or anti-clockwise. The important thing was that the inlet from the down-gate should be large enough to keep the whirl gate full so that the outlet did not take away slag and dirt, and secondly, the inlet to the whirl bob should be in the proper positional relationship to the outlet and not, as had been seen from some of the illustrations, directly opposite.

Replying to Mr. Kain on the question of the analysis of wasters, he said he used a standard detailed daily record sheet. Someone once said there were some 57 different ways of making a defective casting, but he did not know the exact number after years of study. He had tried hard to list them all at various times and had a feeling that there might be hundreds, but, of course, in daily foundry practice it was impossible to get down to such detail as that. Therefore a reasonable limit must be placed when making out a weekly or daily sheet for the analysis of defectives and he would be pleased to show anyone interested a sheet which he used for that purpose. As to how this information could be inculcated into foundry practice, all he could answer was that it could be best done in the manner he had done it that afternoon. He had found that in nine cases out of ten the moulder was keenly interested in his job and he would always go and see something that he could argue about, even if it were outside working hours. He had seen some very large audiences at such times and even bigger ones if it were in working hours.

Whirl-Gate Design

MR. SUMMERS expressed the view that the average practical foreman had tried all the methods that had been illustrated by Mr. Currie but did not then get 100 per cent. It would be interesting to have the author's view with regard to temperature as well as design of whirl gates. Something had been said about the risers letting the dirt out of the mould but it should be stressed that risers did not take the dirt out of the metal or clean the slag out of the mould. Horn runners were not in use as much as they used to be but he saw no reason why they should not be. Speaking of turbulence, he said it was well known that in the case of high-duty metal, turbulence would bring out the scum.

MR. G. C. PIERCE remarked that, unless he had been missing something during Mr. Currie's talk, no mention had been made of the most efficient runner, *viz.*, the spinning runner. He also had tried to analyse at different times what was the percentage of wasters due to runners and runner basins, and joined issue with Mr. Currie's figure of 20 to 30 per cent. It might be that Mr. Currie had been particularly unfortunate in his foundries, because he felt that this percentage was very high. He would rather say that sand condition and sand running were responsible for a greater percentage than either gating or running. He agreed that the runner must be kept full, and that applied to most metals. Again, he felt he must join issue with those who suggested that the runners could be allowed to empty themselves, or nearly so, and allow the air to come down to create a vent. Most emphatically, if he wanted a vent to be created in a mould, he would take care it went through another place and not up the runner stick.

MR. MCRAE SMITH pointed out that nearly all the illustrations that had been shown were of side running, and asked if similar demonstrations had been given by cinema to show the advantages of top and other forms of running. In the case of the very small pulley which was shown, perhaps side running would be beneficial, but had the author had experience of picturing the flow of metal in a spoked pulley run by two small jet runners on the central boss or from a ring runner from the outside? With regard to the flat castings illustrated, he realised the illustrations were used for the purpose of showing good examples of getting metal into the mould without scum or slag, but to run the flat castings in the manner shown it seemed to him would result in cold metal getting to the side of the casting remote from the runner, and there would be a great tendency to create hot spots. Finally, he asked if Mr. Currie thought it would really be a practical proposition to run flat plate castings of the type shown from two sides if there was to be uniformity of structure in every part of the plate.

Temperature of Pouring

MR. CURRIE, replying to Mr. Summers' question on the temperature of pouring, said that, as a general rule, he poured as hot as possible. In recent years he had taken great interest in high-duty irons, and with their short freezing range it was necessary to melt and pour as hot as they could be got out of the cupola. As to Mr. Summers' disagreement with the view that risers would bring dirt out of the mould, it was perfectly true that the main function of the riser was to feed a section of the mould and to make up for any loss due to shrinkage of the metal in that particular quarter. At the same time, he felt sure that Mr. Summers' experience would agree with his own that in the case of certain castings, such as cylinder liners, where it might not always be possible to get a good ring of pop gates all round the top, it might be necessary to use runners on the one side. There was thus a tendency to scum formation, which was swirled round to come up again on the opposite side to the runners, and it would be found that a riser here would take out that scum and slag. It was purely a question of the type of casting being dealt with. As to turbulence, it was well known, of course, that this, in a ladle, would bring the scum to the top, but there was no necessity to apply turbulence or shaking up in a runner system in order to obtain the desired results.

In reply to Mr. Pierce, he said he had shown one or two designs of the spinning runner, but, personally, he would not use the type illustrated at all times, because he felt considerable improvements could be made in it. Perhaps he had rather emphasised side-running, as mentioned by Mr. McRae Smith, and he had to admit that, to a certain extent, it might be difficult to produce a film such as that suggested. Of course, he was well aware that very many castings were top poured. The question of whether it was better in the case of a gear to put the runner on the centre boss and let the metal flow outwards instead of the reverse was one which foundrymen could dispute and argue about for hours. In cases where the outside rim was exceptionally heavy or where teeth were to be cut, the side runner might create dangerous hot spots, and there may be porous spots in the bottom of the teeth. In such a case, he would agree that running from the centre boss was the best. If, however, they were dealing with a metal which had high shrinkage, centre runners directly on the boss could be dangerous. He had found it an improvement in such cases to put a riser on the centre boss and to gate directly into the riser.

MR. MCRAE SMITH: That is what I meant.

MR. CURRIE, continuing, said it was possible to go on for hours on a subject like this. All he was trying to do was to stimulate imagination on a broad chosen series. It was possible to get down to exact details of many similar cases, but there was a time and place for all of them. In the case of the flat casting mentioned by Mr. McRae Smith, admittedly the way of casting that which was shown may not be the best, but probably it suited the particular foundry and the method adopted could be adapted to the conditions. It was necessary to consider the type of casting first. A floor plate could be flushed from one end. A surface or jig plate, which must not warp or distort, may even have to have runners all round it. The example shown was a type rather than a recommended method of gating.

Rod Feeding with Small Riser

MR. V. WARREN, speaking with regard to high-duty irons, said he had not been associated with them for very long, but he realised they must have a feeder head where there was a thick and a thin section. Generally, there would have to be a big riser and, unless there were no facilities to take these risers off with a flame cutter of some sort, it would be a big job to saw them off by hand. Therefore, such castings must be rod fed if a smaller riser were used. When doing that, however, he realised the work needed to be in the hands of an efficient moulder who knew what he was doing.

MR. CURRIE said he was sorry to tell Mr. Warren that he himself was antagonistic to rod feeding at all times, because there were so few skilled moulders who knew how to use the feeding rod properly, especially with high-duty irons in the low-carbon/low-phosphorus series with accelerated cooling rates. In such a case one was running into great danger in trying to use the rod, and he preferred to have a riser of a proper size in relation to the section to be fed.

MR. CURRIE, continuing, said there was really no difficulty in knocking off risers up to as much as 6 in. square, where the pad at the bottom of the riser had been shaped properly on to the particular job. After a start with the chisel the riser would break off cleanly.

MR. WARREN said he did not like rod feeding, but there was always the great difficulty of getting large risers off.

MR. CURRIE said Mr. Warren was very fortunate if he had a moulder who knew how to use the feeding rod, because the majority did not.

MR. KING, commenting on the stress laid by Mr. Currie on the proper skimming of the ladle before pouring, said he noticed that in some of the pictures there was an accumulation of slag. Was that intentional?

MR. CURRIE said it was necessary to make a good demonstration. If the ladle had been thoroughly skimmed, it would not have been possible to see the slag effects clearly, so that, to some extent, the presence of the slag was intentional.

Vote of Thanks

DR. A. B. EVEREST, proposing a vote of thanks to Mr. Currie, said they had listened to a unique talk in which one detail of the whole foundry problem had been isolated and studied in a very thorough and quite unusual manner. The talk had been excellent, but it had left him feeling very much like Oliver Twist—he wanted to ask for more. On the question of the percentage of wasters, he said, this raised many points, and everyone would have liked to have heard more about the influence of other factors, such as speed of running, dimensions of in-gates, risering, etc., in relation to getting sound castings. Obviously, the author could not deal with risering in the time available, but the pictures were remarkable in that they gave quite a new insight into the behaviour of the molten metal entering the mould. The Paper suggested all sorts of further lines of attack, which he hoped Mr. Currie might consider at some future date.

MR. P. A. RUSSELL, B.Sc., who seconded the vote of thanks, said he had come specially from

(*Concluded on page* 169.)

Strainer Cores

By JAS. TIMBRELL.

The actual pouring of moulds in the foundry has always been considered to require much practice in order to be successful in developing that initial "tip" to fill the runner basin quickly and without wasteful splash, associated with a proper anticipation of the "following up" speed, with which the runners take the flow. This experience is necessary in casting assorted moulds of various weights and where casters do most of the pouring. Tea-pot ladles, skimmer-lipped shanks, runner stoppers and perforated tins are all of some assistance in securing clean castings free from dross.

With labour dilution and the entry of trainees into the moulding shops, strainer cores will do much in the direction of reducing scrap on important work through faulty pouring. These are simple to apply, and in this article several examples of their uses are set out as a guide.

A strainer core (inset E, Fig. 6) consists of seven pencil-type runners (more or less), through a tapered core; four sizes—$\frac{3}{16}$ in., $\frac{1}{4}$ in., $\frac{5}{16}$ in. and $\frac{3}{8}$ in.—will cover most requirements. Ample space round the pegs for easy ramming should be allowed; they should be rammed up hard in a quarried sand, with a small addition of core oil and some carbon blacking. This sand when dried will stand up to the cutting action of high temperature metal, whilst the oil renders the cores resistant to mould moisture absorption.

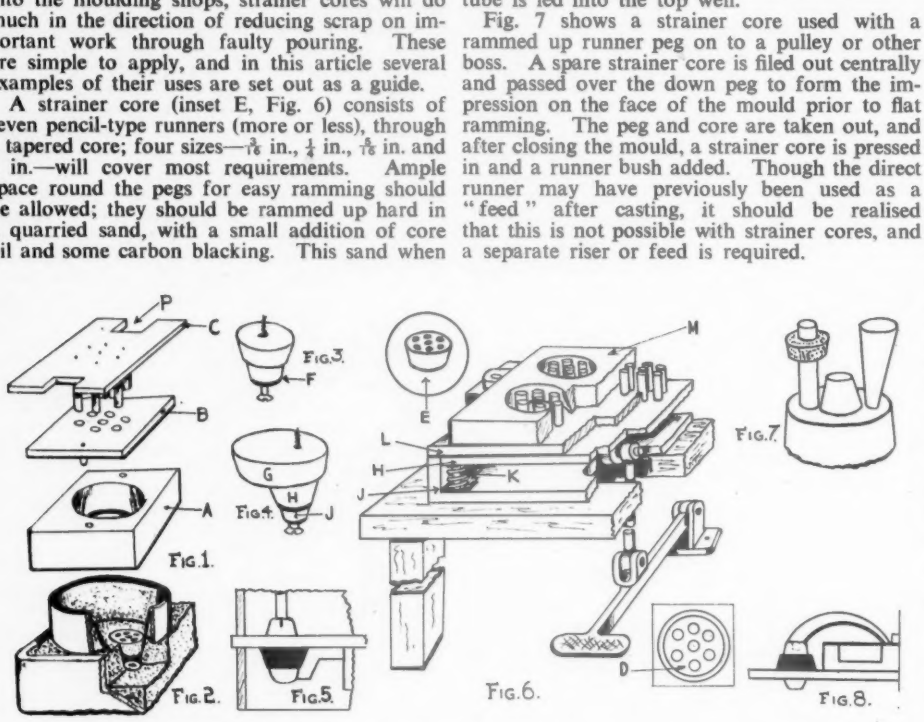

Fig. 1 shows a simple stripping plate core box for making strainer cores singly. The body A is of cast iron, the tapered hole being made from a piece of round core filed down to suitable taper and thickness. It is blacked up and cast in place. This body is trimmed up dead level on the 2-in. faces. The stripping plate B is also a flat piece of cast iron, placed in correct position on the body, dowelled, and marked off as is shown in the inset D, of Fig. 6. The extended bottom plate made to the shape C has clearances for the thumbs, this is secured to the stripping plate B, and the two drilled together to the required pin size.

Suitable pins are fastened into the bottom plate C, and the holes in the stripping plate are eased on the pins to facilitate stripping and for freedom in working. Separation is made easy by thumb pressure between the clearances P, the extended lugs on the bottom plate engaging with the fingers.

Fig. 2 shows the simplest and quickest method of using strainer cores in a mould, bushed up in the usual manner. It will be noted that a "well" is necessary below the pencil inlets; this is formed from the pattern with a rounded edge as shown at F (Fig. 3). It is attached to the presshead when used with squeeze machines. The cutter tube (where used) is pressed down the centre of the "well" in the usual way. When using rubber compression "sprues" or runners, allowance for shorter length has, of course, to be made. On closing the moulds a strainer core is pressed into each taper and bushed up as usual.

On moulds where it is the practice to form the runner basin by "fingering" or scooping out, a "former" made to the shape of Fig. 4 will cut out this operation, if such a pattern is attached to the presser head. The top shape G will form the previously scooped-out basin, and the shape H will form the taper to take the strainer core, and underneath is the "well" J to take the cutter tube.

If it be desirable to run one casting in a group in a box with a strainer core, then a well above and below is necessary, and is applied as is shown in Fig. 5 to a pattern on a hand plate. The inlet runner is taken from below, and the down tube is led into the top well.

Fig. 7 shows a strainer core used with a rammed up runner peg on to a pulley or other boss. A spare strainer core is filed out centrally and passed over the down peg to form the impression on the face of the mould prior to flat ramming. The peg and core are taken out, and after closing the mould, a strainer core is pressed in and a runner bush added. Though the direct runner may have previously been used as a "feed" after casting, it should be realised that this is not possible with strainer cores, and a separate riser or feed is required.

Fig. 8 shows the strainer core used in conjunction with a horn type runner, as applied to a gear wheel or cut grooved pulley. This is a case where an inlet gate on the outer rim would cause shrink spots or open grain (shown up usually after machining). Run on the centre boss as shown, the casting will cool evenly on the outer rim. If it be decided to adopt strainer cores in a general way, Fig. 6 shows a bench unit for making these in quantity. The bottom plate H with the fixed pencil pegs slides up and down in the baseplate J. Springs and guide pins K hold this plate in register against the face of the stripping plate. This is a fixture on the baseplate, and has two fixed guide pins to position the top body plate M. This top body plate is made in a similar way to the hand corebox previously described. Any number of cores may be set in lines in a mould to suitable shape and enough to fill any standard core plates in use. This body plate is, of course, machined level top and bottom.

The procedure is as follows: The cores are rammed up in the usual way, and after strickling off, depressing the pedal withdraws the bottom plate and the pencil pins through the cores. A rap or two on the top body plate eases stripping, and leaves the rows of strainer cores to be removed on to a core plate for drying. It will be noted that the direction of the taper in this case is the opposite of that of the hand corebox.

(*Continued at foot of next column.*)

Swedish Iron and Steel Notes

Oxelosunds Jernverke A.B. is the only producer of coke pig-iron for sale in Sweden. That produced by Degerfors Jernverks A.B. and Domnarvets Jernverk is consumed in the steelworks. Construction of new blast furnaces has resulted in greater production of pig-iron. An increase in output of finished rolled iron products made from coke pig-iron also is noticeable at a number of works. Manufacture of charcoal pig-iron is at capacity, and will be maintained as long as charcoal can be supplied. The only charcoal pig-iron exported from Sweden at present is a small quantity shipped to Germany in accordance with the Swedish-German clearing agreements.

Normally, 90 per cent. of Sweden's supplies of beams and girders are covered by imports, chiefly from European countries. During the first half of 1941 these were supplied exclusively by Germany, but deliveries were short 110,000 metric tons. In July, 1941, imports from Germany showed an upward trend, and were expected to be maintained at a more normal level for the rest of the year. Deliveries of iron and steel products from Germany to Sweden will not be fulfilled, although these imports are necessary to maintain the building industry even at its present low level.

There is a good domestic market for Swedish-made, high-quality, steel products, and the loss of export markets is to a certain degree compensated by increased domestic consumption. Owing to the German-Finnish war with the U.S.S.R. exports of high-quality steel products to Russia have ceased. Exports to Germany are hampered by clearing agreements, and the only remaining European markets are Switzerland and Italy. Small amounts of Swedish iron and steel products are being shipped to South America, but exports of high-quality steel to these markets have declined to a minimum. Prices for high-quality steel products in the domestic market show an upward trend owing to higher cost of production caused by increased expenses for domestic fuel—charcoal and firewood—which have gradually replaced coal and coke. Charcoal stocks for the current season are small, and many plants may close unless charcoal production is increased. Consumption of charcoal by iron and steel works last year is estimated at over 2,000,000 cub. m.

Although imports of scrap iron have been stopped, stocks on hand seem to be fairly adequate, owing to a great extent to intensified scrap collections. Large supplies of scrap have been obtained at regular intervals from engineering shops and shipbuilders. Eventually, however, there will be a shortage of scrap, as collection campaigns have to a large extent exhausted stocks on hand.

Owing to the shortage of copper, iron is now being utilised successfully in the manufacture of electric cables for power and transmission lines. Electric cables made of galvanised iron from 3,000 to 11,000 volts are used almost exclusively for transmission lines in the rural districts. Investigations are being made to utilise electric cables and wire made of iron for other installation purposes.

It is not certain whether Swedish production of iron and steel can be maintained at the present level in the future, states a U.S. consular trade report. An anticipated shortage of pig-iron and scrap undoubtedly will cause a further decline in the production of iron and steel. A meeting of the Swedish and German Government Clearing Commissions was held at Stockholm in September, and it was decided that deliveries of commercial iron, coal, and coke would be increased during the latter part of 1941. To facilitate deliveries of these products during the first half of 1942 the Swedish State Board for Reserve Supplies has advanced 100,000,000 Kr. to the Swedish-German clearing fund, which it is hoped will be repaid through deliveries of German goods in 1942.

(*Continued from previous column.*)

A further development of this machine is to jig-drill the required number of core plates to the pin settings and place one of these each time between the stripping plate and the body. This will allow the cores and plates to be removed together each time. Allowance on the pencil pins is, of course, necessary to compensate for the thickness of the core plate.

The Manufacture of Malleable Castings by the Whiteheart Process*

By A. E. DAVIES†

The object of this Paper is to give a concise and comprehensive description of the various operations necessary for the manufacture of malleable castings by the whiteheart process, mainly on the lines of a comparison with the manufacture of common iron castings, particularly with regard to the moulding operations.

Good malleable castings are a very dependable product, and during these days of war effort many articles which were previously made as steel forgings or steel castings have been replaced by malleable castings. In certain cases this in no way impairs the dependability of the finished product, but it would not be correct to say that malleable castings were as good as, or as dependable as, the best steel forgings or castings. In recent years very much progress has been made in the direction of improvement and uniformity of quality.

Unlike grey iron castings, the manufacturer of malleable castings has a process of manufacture to deal with, before he comes to the varied foundry problems with which the foundry manager is only too well acquainted. But by strict adherence to good foundry practice, correct mixing of metals to suit the various sections of castings, and careful control of subsequent heat-treatment operations, comparatively trouble-free foundry practice can generally be realised.

Malleable castings are rather more difficult to make than common iron castings, chiefly by reason of the larger contraction and greater shrinkage of the metal, and also on account of the excessive brittleness of the casting in the unannealed condition, but the difficulties do not present much trouble if the usual methods at one's disposal are applied in the proper manner.

Metal Mixing and Furnaces

The first essential to the manufacture of good malleable castings is metal mixing, and if this is laboratory controlled, so much the better; but if the analysis of the metal is not correct in the first place, no amount of good foundry practice will make it so. Hematite irons are the base of these mixtures, and they are available in various qualities. A few years ago manufacturers of malleable castings used almost exclusively a refined hematite mixed only with returned unannealed scrap from the foundry. Steel scrap, if used at all, was used only very sparingly, but to-day many manufacturers are using hematite iron direct from the blast furnace and mixing it with good-quality steel scrap of suitable size, often in proportions up to 50 per cent., together with returned unannealed foundry scrap, and also returned malleable scrap.

Broken ingot moulds, a source of material available at all steel-melting works, may be used in place of hematite iron, but these days the price of this material is very much the same as that of hematite, and the advantage in price is only available to those manufacturers whose works are near to a steel-melting plant. The writer used this material successfully as far back as 1922; it was then not generally known that broken ingot moulds made a splendid substitute for hematite iron, but quite a good run was obtained on this material until the demand forced up prices.

The metal mixture is melted in much the same way as would be the case with common iron castings using the cupola, open-hearth furnace, pit furnace, or, what is becoming more popular to-day, the rotary furnace (this furnace, of which there are many types, has decided advantages over all other methods of melting malleable iron mixtures). The furnaces are heated in various ways, using gas, pulverised coal, fuel oil, etc., but in all cases the great advantage when using the rotary furnace is the ease with which various metal mixtures can be adapted to suit varying sections of castings. This is one of the most important points in the manufacture of good malleable castings, since a metal mixture that will admirably suit a casting having an average section of, say, ¼ in., would be totally unsuitable for a casting having an average section of 2 in.

Another great advantage of the rotary furnace is the perfect mixing and temperature control which is derived from its use, and which are very vital factors from the standpoint of uniformity of grading. Many methods and modifications of melting are in use by various manufacturers with this type of furnace to get continuity of metal supply, with an analysis best suited to the particular section of casting being made, but they are much too numerous and involved to survey adequately in this short Paper.

Functions of Silicon

Silicon plays a very important part in all malleable mixtures, for it is this constituent which chiefly controls the form in which the carbon will be present in the unannealed casting, a factor which is perhaps of paramount importance. Silicon greatly assists the foundry manager from the moulding and casting point of view, but excesses should be avoided, since the higher the silicon content of the mixture, the greater will be the tendency of the carbon present to be precipitated during the cooling of the hard casting; also the presence of graphitic carbon in the structure of the hard casting is absolutely fatal.

Silicon additions alone do not assist in the removal of carbon during annealing, but the ideal mixture is one in which a satisfactory combination of silicon, carbon, sulphur and manganese are balanced in such a way that the silicon is not too high, and the carbon low enough to ensure that all the carbon present in the charge will be in the combined form—that is, as ferric carbide which is visible under the microscope as cementite and pearlite—and not in the free state as graphite. Excess of sulphur does not favour graphitisation, and a mixture with relatively higher silicon and sulphur will give a graphite-free structure in the hard casting.

Manganese neutralises the effect of sulphur by the formation of manganese sulphide, and retards the removal of ferric carbide during annealing, and excesses should be avoided.

Most hematites can be bought to-day with guaranteed analyses, and it is desirable to buy irons with an analysis, particularly of silicon, carbon, sulphur and manganese, to ensure that the resulting mixture will give a perfectly white fracture, especially in the thickest part of the casting, and at the same time provide a mixture the carbon of which is not too stable to require excessive annealing to bring about its malleability.

Silicon considerably helps the fluidity of the metal, and this is a fortunate circumstance, particularly to the manufacturer of thin malleable castings; small sections of, say, 1/16 in., which are very difficult to cast economically in the foundry, can be cast quite easily and safely with a mixture of considerably in excess of 1 per cent. of silicon.

Silicon additions, however, cannot be taken advantage of to the full from the fluidity of the metal point of view, unless great care is exercised in carefully balancing those elements which retard graphitisation. For, as stated earlier, silicon produces conditions which favour the precipitation of graphite, and the presence of silicon in excess does not improve the characteristics of malleable castings.

Composition of Mixtures

No definite percentage of any element can be given as a basic value, since the effect of any element depends on a variety of conditions and foundry practice, casting temperature, etc. Generally speaking, the silicon content of the metal mixture varies between 0.4 per cent. silicon for heavy castings up to and in excess of 1 per cent. for very light castings.

The writer has conducted various experiments with varying metal mixtures, with extraordinary results, using combinations of silicon, carbon and sulphur. Some very good results were had from freak mixtures containing up to 0.8 per cent. of sulphur, with a relatively high silicon of 1.2 per cent., which is very extravagant, certainly as far as sulphur is concerned. All this goes to prove the necessity of balancing the mixture from the standpoint of the stability of the iron carbide contained in the mixture. The stabilising of the carbon, by introducing excess of sulphur, is particularly evident in this experiment, and the author believes that a complete research in this direction would provide some astounding results.

The general practice, however, is for the sulphur content to be fairly low, about 0.1 to 0.2 per cent., and a manganese of twice that amount (0.2 to 0.4 per cent.), which allows a fairly good margin of silicon to provide a good fluid iron at normal melting temperatures, with freedom from graphite, in the unannealed casting.

The percentage of carbon in the mixture is perhaps taken less into account than any of the other elements; yet it plays the most important part. It is the part removal and breaking down of this element during annealing that converts the hard and brittle casting into the soft and malleable casting. The presence of carbon in the unannealed mixtures is absolutely necessary, although it has to be removed during annealing.

Without carbon the melting point of the mixture would be so high that it would not be practicable to melt it in the same way as the normal mixtures. Carbon gives the metal great fluidity, and, if it is not present in very great excess, does not give rise to excessive annealing. As stated earlier, it should be low enough to ensure that no graphite is present in the structure, as this precipitated graphite cannot be easily removed; in fact, if it is removed, it leaves cavities and spaces in the metal, which give rise to mechanical faults. If care is taken to ensure a safe margin on the ferric carbide side, very little trouble will be experienced.

Moulding and Casting

The moulding and casting of the molten mixture is brought about in much the same manner as would be the case with ordinary common iron castings; perhaps greater care is taken to avoid oxide skimmings from entering the mould. These oxide skimmings appear to be more abundant on the surface of the molten metal than would be found with common iron castings, but they are easily prevented from entering the casting proper if the usual method of taking the gate from the bottom of the main runner is adopted.

Spinning gates are used frequently, and because the metal has a high shrinkage, larger feeding heads will be required. Even very small castings weighing less than 1 oz. will re-

* Paper read before the Institute of British Foundrymen.

† Thos. Crompton & Sons Ltd., Ashton-in-Makerfield.

Whiteheart Malleable Castings

quire to be studied from the standpoint of where the gate should be. In general practice, with these small castings, it will often be an advantage to arrange the gate in the thickest part of the casting, or that part that will be the last to solidify, incorporating in the gate a small feeding head proportional to the amount of feeding that will be required.

Large castings will often require several feeding heads, in which case it is not necessary to place the gate in the thickest part of the casting; in fact, it is often an advantage, when using several feeding heads, to gate the casting in the thinnest part, or that part of the casting that is expected to solidify first, and to pour the mould until the metal has completely filled the casting and also about one-third of the feeding heads. Pouring is then halted until the metal in the gate has solidified; the feeding heads are then filled up to the top with hot metal, and the feeding left to take care of itself.

This method will be found to provide perfectly sound castings, except in the most obstinate cases, when the foundry manager has to resort to the use of denseners or chills, which are very popular in the malleable foundry, particularly when high-duty castings are required, or when the castings have to be routine tensile tested, which is often the case with malleable castings.

Care should be exercised when using a chill on a particular part of the casting to see that that part of the casting is well fed, as the chilled part of the casting will be made sound at the expense of another part of the casting; careful combination of chills and feeding heads will be found to deal effectively with the most obstinate case of unsoundness.

Unlike common iron castings, chills do not cause any inconvenience, since obviously all malleable castings have to be heat-treated.

The quick cooling brought about by chills will often be found to improve the mechanical properties of the material, apart from making the casting more sound, and this is particularly evident with the bend test. Over-chilling should be avoided, since this causes weakness; test bars, for instance, cast completely in chills have very poor mechanical properties

The finished hard or unannealed casting is cleaned in much the same way as common iron castings, always remembering that the castings are very brittle and will require very careful handling. Shot-blasting is more popular than barrelling; all sand must be completely removed from the castings before annealing. Any sand left on the casting will become fused on to the castings during the subsequent annealing process, with disastrous results to cutting tools if the castings have to be machined.

This complete removal of the sand is also particularly important if the malleable castings have to be galvanised, tinned, or electro-plated. It is practically impossible to obtain a good coating if the hard castings are not completely cleaned of all sand before annealing.

Normalising and Cracking

By reason of the fact that the casting in the annealed condition is very brittle, precautions have to be taken to prevent certain types of castings from cracking or breaking during cooling; this is only necessary with medium or large castings, and becomes almost essential when the castings have numerous varying sections, or the castings are of such a shape that they do not cool uniformly.

The high contraction of the metal, together with the unequal cooling of the various sections, causes great stresses and strains to be set up, and the metal, not having sufficient elasticity, ruptures if the castings are not normalised. The breaking or cracking of the castings at this stage is not a fixed rule· sometimes it happens that these stresses and strains are not sufficient to break the casting during cooling; often the castings will not fracture until additional stresses are put on the material during heating up for the subsequent annealing operation, and if normalising has not taken place this causes a very serious loss to the foundry.

In all cases where cracking is likely to happen the castings have to be normalised; this preliminary short heat treatment, apart from relieving all stresses and strains, slightly toughens the metal.

The types of casting that it is thought necessary to normalise are taken from the sand as soon as the metal has set sufficiently to permit their removal with safety, and transferred as quickly and as hot as it is possible into a normalising furnace. This furnace is generally situated very near the parts of the foundry where this type of casting is made. They are heat-treated at a temperature of 850 deg. C. for about 8 hrs., and allowed to cool slowly in the furnace, when they are taken out; they should be cool enough to handle easily.

Normalising will prevent most castings from cracking, but the amount of heat-treatment must depend on the liability of the casting to crack.

Obstinate cases of cracking may be obviated by the use of a combination of methods of moulding, chilling, casting temperature and prolonged normalising. The effect of normalising is to alter slightly the structure of the metal: the cementite areas are slightly broken up and the pearlitic areas become slightly more abundant.

The necessity of normalising certain castings must not be confused with cracking, which may be caused by faulty foundry practice. Cracking is often caused because the contraction of the casting relative to the contraction of the main runner has not been taken into consideration This fault is often common with very thin and long castings, which require to be gated in several places to avoid what is called misrunning. The main runners, being thicker and stronger than the casting, are the last to cool and contract: in fact, with this type of casting the casting has often solidified and contracted long before the main runner, and when the main runner eventually contracts, the stresses are so great that the casting cracks.

This type of cracking can be avoided by casting from two or more ladles, splitting up the runner accordingly and arranging the gates and runners so that the longitudinal contraction of both casting and runner are equal.

When these thin sections are of the highly repetition class, and speed of moulding and casting is more convenient when only one ladle is used, this cracking trouble may be overcome quickly and easily by breaking the main runner before contraction takes place, without disturbing the casting. This is done by giving the casting head a good blow with a hammer, or, what has often been seen in the foundry, the moulder using his heel for a hammer—a method not recommended, but which is nevertheless effective. The castings are then left to cool normally in the sand.

The Malleablising Process

The cleaned castings are now ready for the malleablising or annealing process. More development seems to have taken place in recent years with this particular part of the process, but the older process in more general use in this country to-day will first be described.

The furnaces used for annealing are various: they vary as much in size as they vary in the method of heating. There are several patent furnaces on the market, each claiming their advantages of fuel economy, mechanical charging, etc., but they are worked on the same principle of heating the charge to the desired temperature for the period of time necessary to soften the castings completely.

The size of the furnace varies with the size of castings manufactured, larger castings requiring larger furnaces, since they require larger pans to pack them in, and furnace capacities vary from a few cwts. to several tons.

Continuous tunnel ovens are becoming more popular, and recent developments in annealing have taken place which have rather eclipsed the old method. The latest method, which it is hoped to describe later, appears to have a very promising future, but this method of short-cycle annealing has not been practised very much in this country.

In the method more generally adopted in this country the castings are packed in heavy cast pans (these are generally made in the foundry), together with a definite mixture of red hematite ore about the size of peas. The mixture is made up of old spent ore from the previous annealings and new ore, the proportion of new ore varying with the thickness of the castings. The packing mixture not only supports the castings through the long period of annealing, but also provides the oxygen necessary to convert the carbon. Lids are provided and all spaces are luted up with sand and water; the furnaces are closed and heated to the required temperature. The annealing is continued for a space of time, depending on the thickness of the casting and, as before stated, the composition of the metal mixture.

The heavy castings are packed in the top pans and the lighter ones in the bottom pans, where the temperature is not so high. Often with some manufacturers the annealing period is as much as eight days, but the general practice to-day is to regulate the silicon and carbon so that a metal mixture is used which will anneal in as little as 48 hrs. at the annealing temperature, that is about five days inclusive of packing the ovens from cold and unpacking (which takes two whole days if the furnaces are not mechanically charged).

Very thick sections will require a little longer annealing, but sections up to 1½ in. will be softened thoroughly in this time; the annealing temperature of the castings is about 980 deg. C., which allowing for temperature lag means that the furnace will be slightly above this figure.

Ore Mixtures

The proportion of new ore to used ore varies with the thickness of the castings, and also the ratio of weight of castings packed in the pans; the more dense the packing of the pans, the more new ore will be required. For general purposes the mixture of new ore and used ore will vary from 1 part new to 3 parts used ore, up to 1 part new ore to 11 parts used ore, the weaker mixture being used for the lighter castings.

The old spent ore is not discarded, but is placed out to weather and used again; the weathering rusts the iron that has been reduced during annealing, providing hydrated ferrous anhydride, which acts in a more mild way than the new ore.

During annealing the carbon is not completely removed from the casting; all cementite areas are completely broken up and replaced by pearlite and ferrite areas, with very small particles of temper carbon distributed throughout the structure. The outside rim of the casting is completely decarburised, and if the annealing process is carried on at too great a temperature or the ore mixture is too strong this decarburised rim will develop into a peel, with deleterious results to the mechanical properties.

Malleable castings made from the correct metal mixture and properly annealed should show absolutely no evidence of peeling.

The concentration of carbon is greatest in the centre of the sections, and care should be taken to see that all the cementite is completely broken up, the pearlite occupying about half of the area at least, the other half of the structure being made up of ferrite or pure iron.

Whiteheart Malleable Castings

Pyrometric control of the furnace is essential if the resulting castings are to be uniform; the recording type of pyrometer is the most popular.

Short-Cycle Annealing: American Practice: Blackheart

The whole of the process of annealing is rather cumbersome, considering the weight of pans and packing material and the time taken for packing and unpacking the castings; this has in a large measure resulted in the evolution of a much quicker and more convenient process of annealing, which entirely dispenses with the use of heavy annealing pans and packing material, allowing much greater ease in handling and considerably reducing the period of annealing.

This short-cycle annealing is carried out in specially constructed continuous furnaces of the muffle type, provided with a pusher type mechanism, which charges the furnace at one end and pushes the annealed castings out at the other end.

The furnace has four separate chambers, the charge passing through each of the chambers during its passage through the furnace; the speed of travel is controlled by the pusher, allowing the castings to remain in each of the various chambers for a definite length of time; processed gas is introduced into the furnace, which prevents excessive oxidation of the charge.

In the first chamber, called the high temperature zone, the charge is quickly heated to the required temperature (about 980 deg. C.), and held at this temperature for the period of time required, depending on the castings to be annealed. The charge then passes into the quick cooling part of the furnace, where cooling tubes regulate the temperature down to that required for this part of the furnace. When the castings have completed their passage through this part of the furnace they are at the temperature of the low temperature chamber, into which they are introduced and allowed to pass slowly through until they arrive at the final cooling chamber, and pass out of the furnace as annealed malleable castings.

The time occupied for the passage through the furnace varies considerably, according to data collected. One malleable foundry reduced the time of annealing after introducing this type of furnace from seven days to 15 hrs., but in this case the furnace was electrically heated.

The castings, as stated previously, are not packed in pans, but are loaded on special trays for their passage through the furnace, the quick heating and perfect temperature control during the various stages of the process, together with the quick method of charging the castings into the furnace, instead of the slow method of packing, resulting in a net saving of more than ten-elevenths of the annealing time when compared with the old-type furnace using pans and packing material.

The capacity of the furnace was 35 tons a day, and the total energy consumption is given as 267 kw.-hrs. per net ton of castings annealed.

Heat-Treatment and Mechanical Properties

The advantages claimed by the manufacturers of this electric furnace are certainly justified by these figures. The mechanical properties of malleable castings can be greatly improved by further heat-treatment. Hardened and tempered, they behave in very much the same manner as steel. Very good results can be had from press tools and bending tools treated in this way, but if the tools are to be used for cutting, it must be remembered that before hardening the decarburised rim of the casting must be first removed, since, containing no carbon, heating and quenching has little or no effect on the hardness.

Hardened malleable iron will give a tensile strength of 60 tons per sq. in., but the elongation is practically nil; the fracture is very similar to that of cast steel. Mechanically, of course, it does not compare with cast steel, and is only intended as a quick substitute.

Malleable castings will not weld successfully. Their welding properties, however, can be improved if special precautions are taken. Very low silicon irons which have been thoroughly annealed give fair results, but they are never quite dependable. Ordinary malleable castings cannot be heated above the welding temperature and retain their malleability. Immediately the heat is raised to the re-solution temperature of iron and carbon, the castings revert very near to the hard condition that maintained before annealing; in fact, this is so pronounced that the writer has found difficulties in machining castings which have become too hot through friction on the grinding wheels during the necessary dressing of the castings.

The British Standards Institution test for whiteheart malleable castings is:—Tensile strength, 20 tons per sq. in.; and an elongation on 2 in. of 5 per cent., with a bend test of 45 deg. over a radius of 1 in. If care is exercised in the choice of new materials, and the metals are mixed to give the correct analysis in the unannealed casting, and the annealing process is conducted in the proper manner, very little difficulty will be experienced in getting mechanical properties in excess of those asked.

Casting temperature and a perfectly sound casting play very prominent parts in improving the mechanical properties. The casting temperature should not be higher than that necessary to produce a perfectly sound casting, and, generally speaking, the castings which in the hard state cool quickest through the critical temperatures of the iron-carbon diagram will be found to have higher mechanical properties.

Fairly low silicon irons or irons in which the carbon is more stable give the best results, but these require more prolonged annealing.

Quite a few manufacturers favour the use of low silicon irons, as these are handled easier from the moulding point of view, requiring very much less feeding apparently; but actually the soundest castings are those made from the slightly higher silicon and more fluid iron, with which special care has been taken to feed properly.

High Purity Zinc, and Zinc Alloys for Die Casting

Two new British Standards for zinc has just been published by the British Standards Institution (under one cover), *viz.*, B.S. 1003, "High Purity Zinc" and 1004 "Zinc Alloys for Die Casting." These specifications have been prepared in order to standardise, for high purity zinc die-casting alloys, the compositions, impurity limits, and methods of control which have been generally approved as good practice.

The development of dependable zinc alloys of high mechanical properties has resulted in a rapid increase in the use of zinc alloy die castings for engineering purposes. These alloys, however, are practically unique in their extremely low tolerance of some impurities, particularly lead, cadmium and tin which, in excess of the specified maxima, cause liability to intercrystalline corrosion, with resultant dimensional instability and loss of strength. Certain of the harmful impurities are always to be found in appreciable quantities in zinc ores, and the basic zinc for the manufacture of these alloys must be specially produced to meet the necessary requirements of chemical composition. Another and serious potential source of impurities in these alloys lies in contamination during remelting of ingot metal.

Copies of this publication (containing two specifications) may be obtained from the Institution, 28, Victoria Street, Westminster, S.W.1. (Price 2s. 3d. post free.)

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Running and Risering of Iron Castings

(*Concluded from page* 165.)

Leicester to hear this talk, and felt that his time had been very well spent. Although he had some reputation of being a metallurgist, he was far more interested in making a good casting. Everybody could copy Mr. Currie's methods. On occasion, when there had been some difficult running problem, he had actually made an open sand mould and studied the manner in which the metal entered the mould. One point was made clear, however, and that was that, whenever liquid iron was in contact with air, slag was formed on the surface. Clean metal might be going into the mould, but in the open air slag was formed. If a closed mould were used and a comparatively reducing atmosphere, that did not happen. That was a point he had noticed in running open sand experiments, and the cinema views that had been seen that afternoon rather confirmed this.

He always tried to impress the people in his foundry that the runner was the most important part of casting. A casting might weigh 10 cwts., and every ounce of the metal had to pass through a comparatively small space and was therefore subject to the most severe conditions. He was glad Mr. Currie had recommended the use of facing sand for runners as well as the mould. As chairman of the Cast Iron Sub-Committee of the Technical Committee he could inform Mr. Brown that the Technical Committee had formed a slide library and if anybody had any slides which they were willing to lend, Mr. Bolton, the assistant secretary of the Institute, would be more than delighted to hear about them. There were, of course, a great many difficulties particularly in regard to indexing. He himself had 200 slides, many of which were copies of textbook things and were probably identical with those which Mr. Brown had. However, he was sure Mr. Bolton would be pleased to help in any way possible.

The BRANCH-PRESIDENT, before putting the vote of thanks to the meeting, expressed his own appreciation of the talk by Mr. Currie, and said he was fortunate in being in the same organisation as Mr. Currie. They were greatly benefited by the fact that the organisation in America had developed the research side of the foundry business to an extraordinary degree and had pooled all their information and sent it over here. In this country, of course, the organisation did the same and the pooling of knowledge in this way would benefit foundries in every part of the world if only the knowledge could be got to them. He was sure the International Meehanite Company would not object to the showing of the slides in other places if only for the reason that at the present moment they would help in the national effort, for it was necessary to subordinate individual interests to those of the nation.

The vote of thanks was then put to the meeting and was accorded with hearty acclamation.

MR. CURRIE, acknowledging the vote of thanks, said it had given him a very great deal of pleasure to come along and give this talk and show the slides and films. It was not an easy job to prepare such a talk on such a vast subject, but he had been amply repaid by his audience's keen attention.

Contributed Discussion

MR. V. C. FAULKNER wrote asking on purely academic grounds, whether a pool of liquid iron contained in, say, a hemispherical basin, on being allowed to run freely from a centrally disposed outlet, would develop a clockwise rotary motion—that is, in the Northern Hemisphere—in the manner of water leaving a bath tub or washhand basin.

Damage Proneness of Factory Plant

PERCENTAGE VALUATION

It is suggested by MR. HAL GUTTERIDGE in a Paper entitled "Proneness to Damage of Plant Through Enemy Action," presented to the Institution of Electrical Engineers, that the extent of damage likely to be caused by air raids to factory plant and services can be classified and estimated beforehand.

According to the author there are five main causes of damage to factory plant consequent upon an enemy attack from the air:—(1) Direct hit from a high-explosive bomb; (2) blast pressure wave from explosion usually accompanied by flying splinters and *débris;* (3) fire caused directly by incendiary bombs, or indirectly by high-explosive bombs; (4) damage from *débris* falling from above; (5) flooding or drenching by water.

Each of the causes has a different effect on different types of plant. In other words, each type of plant has a proneness to damage, depending upon its physical characteristics, which can be indicated beforehand. All plant can be classified in this respect and limits set out within which the damage is likely to fall. Two examples will illustrate the method. The first example, a blacksmith's anvil, is unlikely to suffer any damage from any of the causes mentioned above except in an extreme set of conditions, in which it might be exposed to a direct hit or to intense heat. Such an item would have a minimum proneness to damage. The second example, at the other extreme, would be typified by some recording control equipment such as a thermostat, thermograph, or gas composition recorder. Such apparatus would be severely damaged by any of the above causes if they were near; in other words, the proneness to damage of such equipment would be high.

"Damage Proneness Number"

It is convenient to denote this variable proneness to damage by a number which will indicate the percentage of the value of the item (in its condition just before the incident) which has been lost by the damage it has suffered. This might be called the "damage proneness number," or "d.p.n." The anvil referred to above could therefore be given a set of limits, to represent the damage likely to occur in average cases, of between 0 and 5, while the d.p.n. of the control equipment could be expected to fall between 70 and 100. These limits must, of necessity, refer to average cases; and whether the figure should be towards the higher limit or the lower limit or whether, in an exceptional case, the figure should be outside the limits, must depend on the judgment of the experienced engineer at the inspection.

As an example between these extremes, a totally enclosed air compressor can be taken. It can be expected that the totally enclosed body and bedplate will not be harmed by the causes mentioned other than a direct hit or persistent fire; but the gauges and pipe connections are subject to damage by blast or falling *débris* and, if they are carried away, they will fracture the flanges on the body. Such an item could therefore be given a damage proneness number ranging betwen 30 and 50 in average cases.

In seeking to establish these limits, the physical characteristics of the item will affect the result in every case except where extreme conditions have occurred. By this method, the limits of probable damage can be narrowed down and placed on a firmer basis, as an aid to the trained observer, in the rapid approximate estimation of the plant value lost.

Classification of Factory Plant

Generally, factory plant can be classified in terms of damage proneness somewhat as follows: Heavy all-metal equipment for the heavy engineering industries, in the form of rolling mills, large presses, steam hammers, etc., will have a low damage proneness number; whilst in light high-speed machines the damage proneness number will have a comparatively high value. The lighter equipment employed in engineering factories, such as lathes, shaping machines, grinding machines, etc., are, in average cases, likely to suffer damage to parts other than the beds or bases when exposed to blast or fire, and the damage proneness number may be expected to lie between 20 and 50; it may be somewhat higher if the electric motor drive has been exposed to heat or flooding. If efficient dwarf protective walls were provided, the damage proneness number would lie towards the lower limit.

Intricate machines of lighter construction will need a much greater proportion of its replacement value to be expended in repair (in relation to the proportion of actual damage) because of the high cost of assembly; on the other hand, the cost of removal and reinstallation will be considerably less than for plant of a heavier type. The high-speed automatic type of machine constructed of fabricated steel has a greater chance of survival than a machine made of cast iron, for the combination of toughness and malleability of the former is, in these conditions, a superior characteristic to the brittleness of the cast iron.

Supply Services

The general practice of attaching service piping to the most convenient point of support has persisted despite the many advantages in accessibility, clean layout, absence of obstruction, and protection from fire or other damage which is realised by placing such piping below the ground floor level in covered channels, with vertical branches only to the points to be supplied. An added reason for such treatment is provided by the threat of air raids, for piping not so arranged is particularly vulnerable to blast, fire, or falling *débris.* It cannot be too strongly impressed that the supply services carried by such piping are the arteries supplying lifeblood to the machines without which they cannot operate. Factory piping should therefore receive the attention which its importance warrants, and improvements should be sought in the following directions:—(1) The total length of the service lines should be as short as possible; (2) the piping should be duplicated within reasonable limits, the second line being far enough away from the first to avoid the possibility of one bomb destroying both; (3) adequate protection should be given by placing the piping underground, or disposing it in other ways.

If piping is attached to the structural members and total collapse of the building takes place, the piping will become a total loss with a damage proneness number approaching 100, for none of it, except the valves, is worth recovering. If, however, the piping has been placed underground, then even with a total collapse of the building, only the vertical "runs"—and these are the less important—will be lost; and the damage proneness number may be expected to lie between 40 and 80.

The cables for the supply of electricity, as well as electric motors, switchgear, etc., are particularly vulnerable to blast, fire, falling *débris,* and especially to flooding. As with piping for the various services, the cables should be run in channels, watertight in this case, with vertical leads to the points of consumption. All main supply cables should be duplicated; they should be laid underground, far enough apart to prevent the possibility of one bomb affecting both of them.

From the viewpoint of this survey, boilers can be classified into two general classes: the first includes Cornish, Lancashire, and fire-tube boilers of that category; and the second comprises vertical and water-tube boilers. Boilers of the first type are heavy objects when filled with water; they are set low, near the ground, and are well bedded, with sides mostly shrouded with brickwork. They offer a high ratio of weight to exposed area, and suffer little damage in themselves, although the steam connections above are likely to receive injury from flying *débris.* The damage proneness number for the first type of boiler is likely to be between 10 and 30 if the boiler settings have not been disturbed. The second class of boiler is more susceptible to damage than the first, for such boilers are built as comparatively high structures, securely held to their foundations, with a high centre of gravity. The damage proneness number of this class may be between 40 and 70.

Solder

The Research Department of Fry's Metal Foundries, Limited, have developed a new lead base solder, TM5, which contains only 5 per cent. of tin. Its use brings about very large savings in the use of tin as normally solders use 20 per cent. of the total national consumption. Its melting point is about 50 deg. C. higher, and its strength when used to lapjoint steel is 2.3 tons per sq. in., as against 2.95 with 40 per cent. tin solder. A complete technique has been worked out and can be obtained from Tandem Works, Christchurch Road, London, S.W.19.

Catalogues Received

Electric Pipe Heating Cables. What at least to us is a new development is disclosed by a pamphlet received from British Insulated Cables, Limited, of Prescot, Lancashire. It relates to the provision of electrically heated cable for applying to pipe lines so as to prevent the freezing of water or the agglomeration of tar oil or other viscous liquids. Within its small compass a mass of valuable data is disclosed. The standard length of cable is 150 ft. and this length must not be shortened as this would violate an electrical fundamental. The various rules and hints for the application and operation are very clearly set out in the twelve paragraphs of a clearly-worded memorandum. This leaflet should be of outstanding interest to those of our readers operating oil fuel furnaces and hydraulically operated moulding machines.

Precision Grinding. The Carborundum Company, Limited, of Trafford Park, Manchester, 17, have with a commendable economy of paper produced an excellent 28-page well-illustrated pocket size brochure, having for its object the equally commendable object of conserving valuable abrasives. It carries the caption "Common Errors in Precision Grinding," and in the main deals with the finishing processes yet here and there appear tips equally useful for the rough grinding of castings. The pamphlet is available to our readers on writing to Trafford Park.

Latin America Mailing List. J. J. Berliner & Staff, of 225, Fifth Avenue, New York City, have sent us a brochure which details a service they have originated of taking a firm's publicity matter, translating it into Spanish and Portuguese, and then mailing it to appropriate firms in the Latin American markets. This pamphlet discloses the existence of no less than 1,435 foundries in the sub-continent. As a peacetime service it has every appearance of being most valuable.

Earth Tester. A four-page illustrated pamphlet received from The British Central Electrical Company, Limited, of 6-8, Rosebery Avenue, London, E.C.1, is especially addressed to users of portable electrical tools. It describes and illustrates an instrument for testing the efficiency of the earthing of such tools in ten seconds. As an increasing number of accidents are occurring in this field, the introduction of such an instrument is timely and worth while.

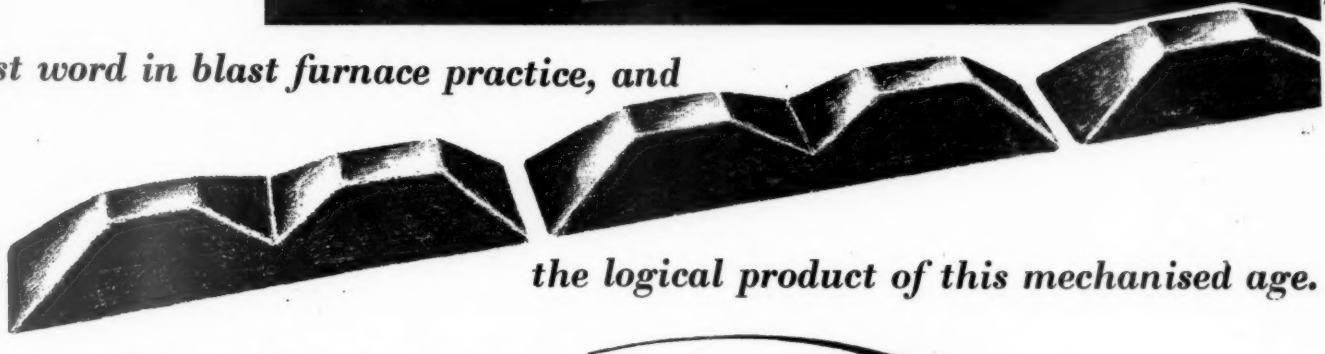
Jointing Tapes. British Insulated Cables, Limited, Prescot, Lancashire, have recently got out a new catalogue covering most aspects of jointing tapes. It is a revelation to the uninitiated to see that there is such a wide variety available.

Canadian Non-Ferrous Metals

An analysis of exports of non-ferrous metals from Canada indicates that output in 1941 was substantially higher than in 1941. Total base metal shipments were valued at $244 million, compared with $195 million. Domestic consumption was also at a higher level. Contracts to supply the British Government with the major portion of Canadian base metal production were recently renewed for a third year, with prices adjusted to the higher costs prevailing, and shortages in the United States have created a demand for a part of Canada's surplus production at somewhat enhanced prices. The nickel-copper industry is engaged in an expansion programme involving the addition of some 20 per cent. to productive capacity. Demand from Great Britain and the United States will undoubtedly continue at record levels; except for scrap, these countries are almost wholly dependent on Canada for their supplies of nickel. Intensive search for deposits of strategic metals such as manganese, tungsten, chromium, tin, antimony, mercury and iron ore is at present being carried on with satisfactory results, says the Royal Bank of Canada's monthly letter.

STANTON

Last word in blast furnace practice, and



the logical product of this mechanised age.

ITS ADVANTAGES ARE MANIFEST

THERE IS NO SAND

THERE ARE NO SOWS

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The Week's News in Brief

Trade Talk

REPRESENTATIVES of the Ministry of Supply and of the trade unions concerned have signed a constitution for factory production committees in Royal Ordnance factories.

A CHEQUE for over £1,400 was collected in two weeks among workers in the Sheffield plant of the English Steel Corporation, Limited, to provide medical supplies for Russia.

DURHAM COUNTY COUNCIL has accepted the tender of Dorman, Long & Company, Limited, Middlesbrough, at £42,258, for the erection of a bridge over the L.N.E.R. line at Billingham Station.

THE OFFICIAL COST-OF-LIVING index figure on January 31 was 100 points and the food index figure 63 points above the level of July, 1914. In September, 1939, the cost of living figure was 55 points above the 1914 level.

SHIPBUILDERS FROM ALL PARTS of Britain have met in Edinburgh and discussed pooling their resources and sharing ideas in order to break all production records. The conference was attended by representatives of the Admiralty.

A MINIMUM basic time rate of 10½d. per hour for Scottish iron and brass dressers has been made by the National Arbitration Tribunal. The rate is subject to the payment of the national bonus. The award will not reduce existing rates.

HOLDERS of the 5 per cent. debentures of William Baird & Company, Limited, have approved the resolutions providing for a reduction in the rate of interest to 4 per cent. and the redemption of one-fourth of each holding at 103 per cent.

IT IS ANNOUNCED that since the national drive to find scrap metal began seven weeks ago, 176,000 tons of metal have been collected, an average of 25,000 tons a week. This has been obtained from sources such as bombed buildings, railings, dumps, and the special county sweeps in Essex, Wiltshire and Cumberland.

THE NATIONAL ARBITRATION TRIBUNAL has made an award on a claim on behalf of crane drivers employed by Cammell Laird & Company, Limited, Birkenhead. The dispute arose out of a claim by the workmen for enhanced payment to crane drivers intermittently or permanently engaged in assisting pieceworkers and for a general wage increase to all crane drivers engaged in shipbuilding yards.

THE BOARD OF TRADE have made the Export of Goods (Control) (No. 11) Order, 1942 (S.R. & O., 1942, No. 367), price 1d., which came into force on March 7. Under the Order export licences will in future be required for all goods consigned to Burma. At the same time the Board of Trade have issued an Order revoking all outstanding Export Licences for Burma (S.R. & O., 1942, No. 368).

CANADIAN CAR & FOUNDRY COMPANY, LIMITED, will receive an order totalling $60,000,000 for about 1,000 Curtiss Navy dive bombers, the Canadian Minister of Munitions and Supply has announced. The order will occupy the full facilities of the company's plants until late in 1944; it calls for 12 months of sustained peak production with a maximum output of 80 planes per month. It is expected the first plane will be completed early in 1943.

PRESIDING AT THE ANNUAL MEETING of Burnell & Company, Limited, Mr. D. C. Jennings, D.S.O. (chairman), said that, although the output from their mills had been fully maintained, the margin of gross profit had declined, due to increased cost of wages, fuel and raw materials. On the other hand, there had been no increase in the selling price of the sheets produced. The policy of the Government for the concentration of production had been applied to their industry, and was put into operation during the latter part of the year.

IN THE HOUSE OF COMMONS recently, Major A. M. Lyons asked the Minister of Supply, as representing the Minister of Production, whether he would now arrange to establish regional executive production councils meeting weekly under the chairmanship of each regional commissioner to ensure administrative decentralisation, acceleration of decisions and economy in money and man-power, and on which supply departments and all other appropriate Government services were represented. Sir Andrew Duncan, in reply, said an *ad hoc* committee had been appointed under the chairmanship of Sir Walter Citrine, composed of representatives of the British Employers' Confederation, the Federation of British Industries, the Trades Union Congress General Council, and of the regional boards, to advise on regional production problems.

MR. PHILIP RUNCIMAN, in his presidential address, to the Chamber of Shipping, said we must have a merchant navy of at least 20,000,000 tons gross. That was our first essential need of the future, without which no military preparations would be of any avail. He had the figures for 55 ships lost during this war. The owners of those vessels had received from the War Risk Insurance Fund £5,872,500. To replace them to-day would cost at least £10,000,000, so that there was a difference of £4,127,500 between the money which those owners had received and the estimated amount required to restore their fleets to their pre-war numbers. Money would have to be found for these three essentials:—To replace the tonnage that had been lost, which the insurance money did not cover, and put the industry on its feet; to provide an inducement for the young men to come into the industry; and to get the industry into such a position that the public would invest in it.

Personal

MR. T. J. PEACOCK, deputy chairman of Guest, Keen & Nettlefolds, Limited, Darlaston, has completed 50 years' association with the company.

MR. JOHN GREEN has been appointed a director of Thos. Firth & John Brown, Limited, Sheffield. He has been a local director of the firm since 1937.

MR. JOHN LANG, of Motherwell, has been appointed by the executive of the Iron and Steel Trades Confederation to be organiser for the West of Scotland.

MR. HARRY WHITE, vice-president of the Derbyshire Miners' Association, has become Labour M.P. for North-East Derbyshire. There were no other nominations.

MR. F. G. STEINEBACH, Editor of "The Foundry," resigned his appointment of technical advisor to the Foundry Equipment and Supplies Unit of the War Production Board on January 31.

DR. F. J. BRISLEE is retiring from the post of chief chemist to British Insulated Cables, Limited, which he has held since 1909. He is being retained by the company in a consultative capacity. Dr. L. C. Bannister, a graduate of the Universities of Liverpool and Cambridge, who joined the company in 1936, has been appointed to succeed Dr. Brislee at Prescot.

MR. O. E. MOUNT, of American Steel Foundries, Chicago, has been elected president of the Steel Founders' Society of America at a recent meeting of the society in New York. Other officers elected at the meeting include: Vice-president, Mr. L. C. Wilson, Reading Steel Casting Division of American Chain & Cable Company, Reading, Pa.; and executive vice-president, Col. Merrill G. Baker. Mr. R. L. Collier was re-elected secretary-treasurer.

Obituary

MR. PATRICK COCHRANE CABLES died recently at his home at Penn, Bucks. Son of the late Mr. Patrick Cables, iron merchant, of Arbroath, Mr. Cables served his apprenticeship as an engineer at Arbroath. Later he entered the service of Dewrance & Company, Limited, of London, with whom he remained for many years.

MR. J. H. CHAPMAN, who has died at his home in Sheffield, aged 81, retired three years ago from the chairmanship of Ibbotson, Bros. & Company, Limited, Globe Steelworks, Sheffield. He had been associated with the firm for 64 years. Mr. Chapman had been three times president of the Sheffield Chamber of Commerce and was one of the founders of the Junior Chamber.

MR. HERBERT CHARLES FRY died on February 19 at the age of 49, at Ealing. Mr. Fry, who was for 21 years with Cox & Danks, Limited, spent the last ten years of his business career as a director of the company. For some time he was at the Sheffield branch, later he became attached to the Park Royal branch, and then he went to the company's offices at Worcester.

Reports and Dividends

(Figures in brackets refer to the previous financial year.)

Lightalloys—Interim dividend of 12½% (same).

S. E. Opperman (Engineers)—Dividend of 10% (same).

Ransome & Marles Bearing—Interim dividend of 5% (9%).

Crabtree Electrical Industries—Interim dividend of 5% (same).

Hammond Lane Foundry—Net profit for 1941, £13,102 (£12,006).

Hepworth & Grandage—Final dividend of 5%, making 12½% (same).

Waygood-Otis—Final dividend for 1941 of 17½% (same), making 27½% (same).

Thos. W. Ward—Interim dividend of 3¾% (same) on the ordinary shares.

Beans Industries—Final dividend of 27½% (same) on the ordinary shares, making 37½% (same).

Cammell Laird—Net profit for 1941, after taxation, £186,548 (£241,852); dividend of 10% (same).

International Combustion—Final ordinary dividend of 15% and a bonus of 10%, making 30% (same).

Federated Foundries—Profit for 1941, £27,115 (loss £42,284); debit brought in, £21,301; credit forward, £5,814.

Davies & Metcalfe—Profit for 1941, £11,621 (£13,279); to reserve, £2,500 (£3,000); dividend of 9% (10%); forward, £2,003 (£2,382).

Spencer (Melksham)—Trading profit for the year to September 30, 1941, after taxation, £24,132 (£27,491); net profit, £7,861 (£11,329); ordinary dividend of 10% (same); forward, £15,593 (£15,226).

Crosthwaite Furnaces & Scriven Machine Tools—Profit for 1941, after providing for depreciation and taxation, £4,107; dividend of 10% (same) and a bonus of 5% (same); to general reserve, £500; forward, £3,317 (£3,382).

Coventry Gauge & Tool—Net trading profit, after taxation, to August 31 last, £139,010 (£339,280, before taxes of £210,962); depreciation, £69,397 (£51,498); dividend of 7½% (same) and a bonus of 7½% (same), both tax-free.

Vickers—Final dividends of 2½%, less tax, on the preferred 5% stock, 2½%, less tax, on the 5% preference stock, and 2½% free of tax up to 6s. in the £ on the cumulative preference stock, making in each case 5% for 1941.

Clarke Chapman—Net profit for 1941, after tax, £112,616 (£122,469); depreciation, £24,563 (£22,845); preference dividend, £4,889 (same); ordinary dividend of 12½%, less tax, £60,000 (same); pensions, £5,000 (same); reserve, £20,000 (same); forward, £34,038 (£38,632).

Tata Iron & Steel—Net profit to March 31, 1941, after taxation and depreciation, Rs. 3,12,84,521 (Rs. 3,28,19,096); to reserve, Rs. 75,00,000 (Rs. 80,00,000); dividend of 38¾% (33⅓%) on the ordinary shares; dividend of 575.42% (479.7%) on the deferred shares; forward, Rs. 11,99,171 (Rs. 16,33,917).

Applications for Trade Marks

The following applications to register trade marks appear in the "Trade Marks Journal":—

"SENTINEL"—Producer-gas plants. SENTINEL WAGGON WORKS (1936), LIMITED, Shrewsbury.

"WELL-HERB" — Machine tools. ROWLAND WELLER MACHINE TOOLS, LIMITED, The Tilt, Cobham, Surrey.

"CREDA"—Rolls for rolling mills. BRITISH ADAMITE ALLOY ROLL COMPANY, LIMITED, Netherton Ironworks, Holly Hall, Dudley, Worcs.

"STANDS WELL" and Device—Measuring gauges and calibrating instruments. OLIVER V. BECKERLEGGE, LIMITED, 100, Button Lane, Sheffield.

"TRIPTOR"—Shaft couplings. JOHN REES THOMAS, "Woodville," Chase Side, Southgate, London, N.14.

"SPEEDIVAC" — High-vacuum pumps. W. EDWARDS & COMPANY (LONDON), LIMITED, Allendale Works, Southwell Road, London, S.E.5.

[Applications to the Cutlers' Company, Sheffield.]

"STRIBAR"—Steel. UNITED STEEL COMPANIES, LIMITED, 17, Westbourne Road, Sheffield, 10.

Contract Open

Grenoside, March 17—Iron castings, tools, etc., during the year ending March 31, 1943, for the Wortley Rural District Council. Mr. J. Gregory, engineer, Council Offices, Grenoside, Sheffield.

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Raw Material Markets

The enlarged demand for special and alloy types of steel has been a feature of the industry for some months past, and has been reflected in changed conditions at producing plants, where units of production have been transferred from the manufacture of other grades now in reduced demand, so as to permit concentration on the qualities which are urgently required for the production of munitions, etc. Better quality irons are still in greatest request, these being needed for heavy engineering works, which are briskly employed on contracts for Government departments. High-phosphorus iron, which was formerly utilised extensively by light-castings makers, is not now moving away too freely, as these manufacturers are quietly placed for new business. A certain amount is, however, being disposed of to heavy engineers, who find they can use this type of iron to eke out supplies of other grades less freely available. The scrap position is not really satisfactory and a great effort is needed if adequate supplies of home-produced metal are to be sent forward to the war factories.

Pig-Iron

MIDDLESBROUGH — Urgent Government orders are keeping the marine and heavy engineering works fully employed; there has been no relaxation in this section for a long time past; nor is there likely to be any lost time while Government requirements are so large. Consequently, consumption of low-phosphorus iron, hematite, etc., is at peak levels, while larger quantities of high-phosphorus iron are being absorbed. Many consumers of the latter have licences to purchase supplies over the second half of the year, and little time is being lost in placing orders, despite the fact that plentiful supplies are on hand at the producing centres. Ironmakers in this district are concentrating on the manufacture of iron for the steel industry, and the output of Cleveland foundry iron is virtually suspended, necessitating users drawing on the resources of the Midlands. They have not been really inconvenienced in this respect, as, so far, deliveries have been good. Conditions in the light-castings branch are unchanged, with new business very difficult to acquire on a scale sufficient to enable them to operate on a full-time basis. While engineers would welcome larger tonnages of low-phosphorus iron, hematite is by far the most difficult grade to obtain and is, in fact, only released in special circumstances.

LANCASHIRE—There is a considerable demand for special refined irons from consumers in the Lancashire area, as these grades are being used to counter the rather poor deliveries of hematite and Scotch foundry irons now coming forward. Ordinary common irons are not particularly active, the bulk of the demand being from heavy engineering foundries. Where possible, needs are being covered ahead and many buyers are under contract up to the end of May. General foundries are by no means overburdened with work, and many could accept a much-increased volume of business, while there is little change to record in the position of light-castings makers and textile-machinery manufacturers, most of whom are unable to work full time.

MIDLANDS—Producers of high-phosphorus iron are not being called upon for very large quantities by local users, but in the aggregate their trade is good, as they are catering for the needs of users in other districts. Demands from the light-castings trade do not expand, as business in this section is still on the quiet side, but the reduction in this branch is partly offset by a moderate call from heavy engineers, who are taking up fair tonnages owing to supplies of better qualities being rather short. Hematite is especially tight and, unless users can make out a good case, they stand little, or no, chance of procuring any at all. Every effort is being made to curtail imports of foreign ores, which are necessary for the production of special grades of iron. The heavy-foundry trade is extremely busy on work of national importance and there is a steady influx of orders from Government departments.

SCOTLAND—The supply of high-phosphorus iron is quite satisfactory, but the same cannot be said regarding low-phosphorus iron and hematite, which are still somewhat tight. Marine and heavy engineering works are in the market for all they can obtain in the way of special irons, but the deficiency is such that increasing use is being made of high-phosphorus and refined grades, which enables the works to maintain continuous operations when deliveries of their usual qualities fall short. A welcome note has been sounded in the Falkirk and district light-castings trade, certain works having reported slightly better order-books. The improvement can hardly be described as general, however, and the trade could take on much additional business.

Coke

Consumption of coke at the various foundries is maintained at a good level and supplies are reaching consuming points regularly again following the disturbed delivery schedule of last month. Users are generally well booked ahead, and all contracts are entered into subject to a rise-and-fall clause. For delivery to Birmingham and Black Country stations, the current price of Durham best foundry coke is 62s. 9d. per ton.

Steel

The high-grade qualities of steel are in great demand and every opportunity is being taken to expand production. Already considerable progress has been made, and plans in being suggest that the rate of expansion will increase steadily. Structural steel is not quite so active as it was in the first two months of the year, but makers are generally in possession of fairly satisfactory order-books, although few can see far ahead. The plate mills are busily employed.

Scrap

Steelmakers and other large-scale buyers of iron and steel scrap are still perturbed at the supply situation, despite the large amount of scrap which is being collected all over the country. While this collection is producing good results in many respects, the volume of scrap suitable for steelmaking and some other processes has not as yet been anything like sufficient to relieve consumers of their anxieties. The authorities earnestly hope that it will not be necessary to raise the present level of scrap imports, but, if this is to be obviated, there will have to be a spurt in the gathering of home-produced material.

Metals

The keynote in all commodities to-day is economy of usage, and in none perhaps more than in the non-ferrous metals, which are all of them so vital to the prosecution of the war effort. Nearly all the metals that matter have become the subject of a control Order, or are obtainable only through the operation of a special process, so that the chances of any consumer acquiring and holding large stocks are remote. Nickel and cadmium, both useful and vital metals, came under official control at the beginning of this year, but there had been before that a close watch maintained on the channels of use, and would-be consumers had to furnish a good deal of detail before they could obtain supplies. From time to time one metal or another comes under special notice, either on account of an increased demand or perhaps, as in the case of tin, because supplies are seriously threatened. Lead is now to some extent in the limelight, for it is already evident that supplies will not be available so easily as in the past, and it may be necessary to pass under review certain aspects of the consumption picture. It may, at any rate, be taken for granted that this metal will be released in future only for essential work, and that the fullest possible use must be made of secondary material. Of late there does not seem to be so much of this about, but it may be that a drive by the authorities would reveal a few hidden hoards of old lead up and down the country. In the meantime, prices of virgin metal are unchanged at £25, delivered consumer's works, on this side, and 6.50 cents per lb., New York, in the United States. America is understood to be continuing her policy of importing as much lead as possible from abroad.

COPPER—The situation shows no change, consumption continuing to be on a very heavy scale both in America and in this country, to which large quantities are moving month by month. Fortunately, at the present time no serious threat to copper supplies is to be discerned as a result of the extension of the theatres of war, but we have been warned by the Prime Minister of greater difficulties in the shipping situation, and it is therefore essential that the utmost economy should be practised in the use of this metal. Among consumers there is no hint of any shortage, but, naturally, metal is only being licensed for essential work connected with the war effort.

TIN—The main sources of tin supplies having now passed into the hands of the enemy, the Allies are making strenuous efforts to eliminate unnecessary consumption of the metal. In the United Kingdom, the objective is a cut in the region of 50 per cent. and already negotiations between Government departments and various consuming industries have brought about a considerable reduction in the use of tin, although it is likely that more severe steps will be taken in the future. Every effort must be made to conserve existing stocks both here and in the United States, where, before the Japanese intervention in the war, something like one-third of the world output was being absorbed for stocking purposes.

SPELTER—Consumption of spelter in the war factories is maintained at a high level. Adequate tonnages are being delivered to meet essential needs, but there is none to spare, so that ordinary domestic consumers stand little chance of getting more than a small proportion of their demands satisfied. Zinc consumption in the United States in 1942 is estimated at 1,019,000 tons, indicating consumption will be about 30,000 tons greater than production. Brass mills are expected to use 50 per cent. more in 1942, while die casting consumption will be curtailed by limitations on automobile and appliance production. Zinc supply for 1942 is estimated at 989,000 tons, including 36,000 tons of Mexican metal. Total metal available outside of Axis dominated countries will be 1,489,000 tons, of which about 1,189,000 tons will be produced in North America.

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